PATENT SPECIFICATION 838,392

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Process and apparatus for use in the application of coatings or coverings of plastic material.

We, KASIKA CHEMISCHE FABRIK G.m.b.H., a German Company of Gradestrasse 60-72, Berlin-Britz, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement :—

The enamelling, paint and varnishing industry is using to an ever greater extent coatings formed by the reaction of several constituents with one another, as, for example, iso-cyanates with polyols, urea resins with various acids, polyester resins with peroxides, epoxide resins with amines.

All these products have the disadvantage of reacting quickly so that the time allowed for the application (pot-life) is very short. This makes industrial application difficult, and necessitates frequent cleaning of the apparatus.

The present invention concerns a continuous process of manufacture of coatings or coverings by the application and polymerisation of a material upon a supporting surface, as well as suitable apparatus for carrying into effect such a process.

It concerns as well as the application of a coating upon a supporting surface, the manufacture of separate coverings that can be formed on surfaces not having proper adherence, such as a plate of glass, or can be coated on products that resist adherence.

It is known how to apply hot or cold, by means of a slotted trough, coatings or coverings on rigid or supple backings, for example sheets, "skins", tissue, wood or metal sheets, with eventual smoothing of these coatings by means of a bar or scraper.

The products mostly used for these coatings are products drying by physical drying or by oxidation, or again products which set; in the first case, the drying can be accelerated by heat.

If such processes were employed with resins which polymerise cold, the polymerisation would take place not only in the coating or covering but equally in the mass of the product accumulated in the trough.

The time for polymerisation depends on the nature of included accelerators and hardeners. It is therefore absolutely essential to apply as quickly as possible the accumulated product, otherwise it solidifies in the apparatus which leads to a sealing of the slots of the trough resulting in an unequal application of the product.

This method then does not allow for continuous work as is necessary in mass production. The tanks or troughs must be cleaned often, and in certain circumstances become even unusable.

Also known is the method which consists of spraying simultaneously the polymerising resin and the hardener contained in different tanks and conveyed by different nozzles. In this way, polymerisation is avoided in the nozzles, but control of the amount of the different constituents causes difficulties and it can happen that the mixture is not even throughout the coating. It follows that the polymerisation is not uniform, which leads to irregularities.

We have now found that irregularity in the density and hardness of the coating obtained can be avoided by applying the reacting organic materials in superposed layers onto the surface to be coated.

According to the invention therefore a process for providing a protective coating, comprising a hardened synthetic resin, on the surface of a pellicle, board, or like article comprises traversing the surface to be coated below

[*Price* 3*s.* 6*d.*]

Price 4s 6d.

two closely spaced falling liquid curtains so that the curtains form superposed layers on the surface, one of said curtains containing one or more of the organic compounds from which said synthetic resin is produced while the other curtain contains a complementary organic compound or compounds which react with the organic compound or compounds contained in the first curtain to form the hardened synthetic resin, and allowing the compounds in the superposed layers to react to form the hardened synthetic resin coating on the pellicle or board.

For example one curtain may contain the diglycidyl ether component of an epoxide resin and the other layer a hardener for the resin, e.g. an amine. Alternatively the diglycidyl ether may be present in one curtain with a dicarboxylic acid which accelerates the formation of the epoxide resin. In another example one curtain may contain a polyester and the other a polyisocyanate. One curtain may contain an intermediate condensate in the formation of a urea-aldehyde resin, e.g. a dimethylol urea and the other layer an acid accelerator for the dimethylol compound.

In particular one curtain may contain a partially polymerised polyester resin and a hardener for said resin while the other curtain contains the partially polymerised polyester resin and an accelerator for the further polymerisation of said resin.

The polyester resin may be one derived from an alphabeta unsaturated dicarboxylic acid, e.g. maleic acid and a polyhydric alcohol, e.g. glycol.

A suitable accelerator for the polyester is cobalt naphthenate and as hardeners there may be used organic peroxides, e.g. cyclohexane peroxide, benzoyl peroxide or cymene hydroperoxide. Esters of phthalic acid and ketones can be used as solvents for the peroxides. The polyesters and the accelerator or hardener can be used dissolved in a polymerisable vinyl monomer, e.g. styrene.

The following Examples give suitable compositions constituting the separate curtains:

First Curtain

92 parts polyester derived from a polyhydric alcohol (e.g. glycol) and an unsaturated dicarboxylic acid (maleic acid)

8 parts solution of cobalt naphthenate in styrene.

Second Curtain

92 parts polyester derived from polyhydric alcohol (glycol) and unsaturated dicarboxylic acid (maleic acid)

8 parts solution of cyclohexane peroxide in methyl phthalate

The cyclohexane peroxide in the above example may be replaced by benzoyl peroxide or cymenehydroperoxide and the methyl phthalate by other esters of phthalic acid or by ketones, e.g. acetone, methyl ethyl ketone, methyl isobutyl ketone.

The application of the different products can be made in any order. For this purpose slotted troughs are preferably used.

A suitable apparatus permitting the application of the products of the invention comprises two troughs positioned at a suitable distance from one another and each connected to a reservoir.

The troughs are equipped with parallel slots for the issue of the product. Below the troughs is arranged apparatus permitting movement of the receiving surface perpendicularly to the troughs, which are arranged one behind the other in the direction of movement. Apparatus may be provided to ensure the return of excess of the product to the troughs, for example a tank may be arranged below the troughs, from which excess product is led back to the feed vat by means of a pump or lifting apparatus.

In one method of operation particularly suitable, the piece to be covered with a synthetic coating slides under its own weight down a working surface inclined at at least 10° at a speed of between 0.25 m/sec and 1 m/sec under the curtains of material falling freely through the slots.

To do this the curtain of plastic material falling freely must be travelling, at the point of contact, at approximately the same speed as the object to be covered. Because the movement of the object to be covered is adjusted to the speed of fall of the liquid curtain, at the point where this contacts the object, which slides of its own accord down the inclined working surface, it becomes possible for the first time to arrange that the object and the lower part of the curtain, as it falls on the upper edge of the object, both have substantially the same velocity.

Thus the leading edge of the object literally cuts the curtain of varnish so that the front edge of the object is not covered, while on the surface of application of the object and, particularly, right from its front edge, there is produced an "unrolling" or laying down of the curtain which avoids all surplus of the plastic material.

The above-mentioned traction effect of the plastic mass can counteract to a great extent the tendency of the object to accelerate since the object is not displaced by a motive force.

The result of this is that the application is always made substantially at the same rate, which guarantees an even thickness over all the surface.

It is only at the moment when the rear edge crosses the zone of impact below the opening of the flow that the traction, on the sliding object, in the direction of the working surface, and the force of gravity act in such a way as to tear off the screen of varnish so that it avoids all surplus, and, surprisingly, the back edge of the object remains uncoated.

The working surface used in order to ease the sliding of objects can have a uniform

inclination or not; possibly it can be curved.

For the control either by hand, or electrically, of the sliding of the objects, apparatus can be provided, mechanical, hydraulic, or electrical, allowing elevation in the inclination of the working surface.

In order to reduce the friction, longitudinal rods can be placed on the working surface which help the sliding of the object to be covered, and which are of a material repelling electrostatically the object to be covered, for example round glass rods.

Also suitable apparatus can be prepared to accelerate the sliding on the working surface, such as rollers driven by a motor and placed transversely to the direction of sliding.

Supplementary apparatus can be provided at both ends of the bearing surface, as receiving and feed installations, for example clearing tables served by belt conveyors.

The description which follows with reference to the attached drawings, which are illustrative but not limiting will permit a ready understanding of how the invention can be put into practice, the details which are shown in the drawing and the text alike being obviously part of the said invention.

In the drawings :—

Figure 1 shows the diagram of an apparatus for carrying out the process which is the object of the invention, by means of drawing apparatus horizontal to the installation, and

Figure 2 shows an inclined table allowing the piece to be covered to slide gravitationally.

In Figure 1, below troughs 1 and 2, a surface 3 to be covered is moved in the direction of the arrow 4 by belt conveyors 5.

The trough 1 deposits on the surface 3 a mixture of polyesters with added accelerators, and the trough 2 a mixture of polyesters with added organic peroxides, or inversely.

Below the troughs are placed recovery tanks 6 and 7 which collect separately the excesses of the two mixtures. From these tanks, the products are led back through feed pipes (not shown) connected to the troughs 1 and 2.

The coatings applied successively on the surface 3 come to be superimposed, according to the process which is the object of the invention, in an unhardened state. At the contact surface from the moment when the two coatings superimpose, there is produced a reaction between the two coatings, in a regular and continuous form, until the final polymerisation.

According to the embodiment illustrated in Figure 2, an object 11 to be covered glides under its own weight down a working surface 12 which is uniformly inclined below two troughs 13.

The surface 12 is furnished with round glass tubes 14 whose repulsive electrostatic force helps the sliding of the objects.

In line with the tanks the round glass tubes 14 are broken so as to allow the curtains of plastic material falling from the troughs 13 to pass through into the receiving tanks, when there is no object 11 below.

At the lower end of the inclined surface there is set a receiving table. At the top end there can also be placed a feed table.

The application process is as follows :

The slope of the working surface 12 is calculated so that the object to be coated, sliding independently, may have a speed practically equal to that of the curtains falling freely from the troughs level with the zone of impact, on the object.

By reason of this agreement of the two speeds, on the one hand, the leading edge of the object literally cuts the curtains so that the front surface of the object does not receive any coating, and on the other hand, it produces on the receiving surface of the object particularly along its back section an unrolling of the screen avoiding all extra thickness.

The viscosity of the product applied produces a traction which counteracts the tendency of the object 11 to accelerate down the surface 12.

As a result the whole operation of application is made at a substantially uniform speed. As soon as the trailing edge of the object has passed below the troughs 13 the traction exercised on the object in the course of its glide, as well as gravity act on that part of the curtain in contact with the rear surface, making in it a sharp cut along this rear edge without any thickening, so that it prevents the back edge being covered.

Obviously modifications can be applied to the method of manufacture which has just been described, notably by the substitution of equivalent technical means, without departing from the scope of the present invention.

Thus there may be placed along the apparatus, installations and reservoirs for the recovery of the excess of the product. The installations for recovery can be placed, not below the tanks as illustrated, but, for example along the issuing slots of the troughs, or again above the receiving surface. The tanks or apparatus for recovery can thus be placed either above or below the receiving surface.

To lift up the excess of the product a suction installation of any suitable kind can be employed, for example rotating absorbent bands placed across the outflow slot. From there the excess of the product is led to the storage vat. The recovery installations can be fitted with scrapers to lift up the excess of the product. These scrapers can be installed on one or both sides of the troughs.

The application apparatus or the troughs as well as the recovery installation can be fitted with heating apparatus, if required.

WHAT WE CLAIM IS :—

1. A process for providing a protective coating, comprising a hardened synthetic resin, on the surface of a pellicle, board or like article according to which the surface is

traversed below two closely spaced falling liquid curtains so that the curtains form two superposed layers on the surface, one of said curtains comprising one or more of the organic compounds from which said synthetic resin is produced while the other curtain contains a complementary organic compound or compounds which react with the organic compound or compounds contained in the first curtain to form the hardened synthetic resin, and allowing the compounds in the superposed layers to react to form the hardened synthetic resin coating on the board or pellicle.

2. A process as claimed in claim 1 in which one curtain contains a hardenable synthetic resin and the other curtain contains the hardener for the resin.

3. A process as claimed in claim 1, in which one curtain contains a partially polymerised synthetic resin and an accelerator for the further polymerisation of the resin, and the other curtain contains the partially polymerised synthetic resin and a hardener therefor.

4. A process as claimed in claim 3, in which the partially polymerised synthetic resin is a polyester, the accclerator is cobalt naphthenate and the hardener is an organic peroxide.

5. A process as claimed in claim 1 in which organic compounds in one or both the curtains are applied dissolved in a monomeric polymerisable vinyl compound.

6. A process as claimed in claim 1 in which one curtain contains a polyester and the other curtain contains a polyisocyanate.

7. A process as claimed in claim 1 in which one curtain contains a diglycidyl-ether (epoxide resin) and the other curtain contains an amine as hardener for the diglycidyl ether.

8. Apparatus for carrying out the process claimed in claims 1 to 7 comprising two closely spaced feed troughs with feed slots from which the curtains are delivered and means for effecting the movement of the pellicle or board in a direction transverse to the direction of the slots and at a speed so that the pellicle or board and the superposed curtains thereon move with substantially the same velocity.

9. Apparatus as claimed in claim 8 in which means are provided for recovering excess of the curtain material fed to the surface of the board or pellicle.

10. Apparatus as claimed in claim 8 in which the feed slots are of adjustable width.

11. Apparatus as claimed in claim 8 in which the troughs and their feed vats are provided with heating means.

12. Apparatus as claimed in claims 8 to 11 in which the pellicle or board is traversed below the feed troughs under the action of gravity.

13. Apparatus as claimed in claim 12 in which the gravity feed is obtained by allowing the board or pellicle to slide down an adjustably inclined surface.

14. Apparatus as claimed in claims 8—11 in which the pellicle or board is traversed frictionally below the feed troughs.

15. Apparatus as claimed in claim 14 in which the pellicle or board is supported freely on endless band conveyors.

16. The process for coating the surface of pellicles or boards with a hardenable synthetic resin substantially as herein described with reference to Figure 1 or Figure 2 of the drawings.

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Fig: 1

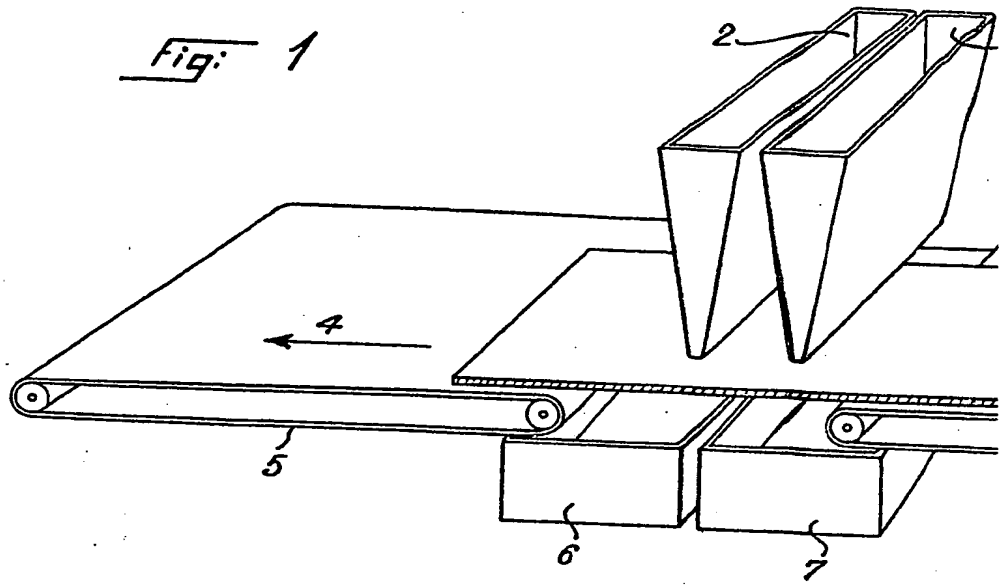
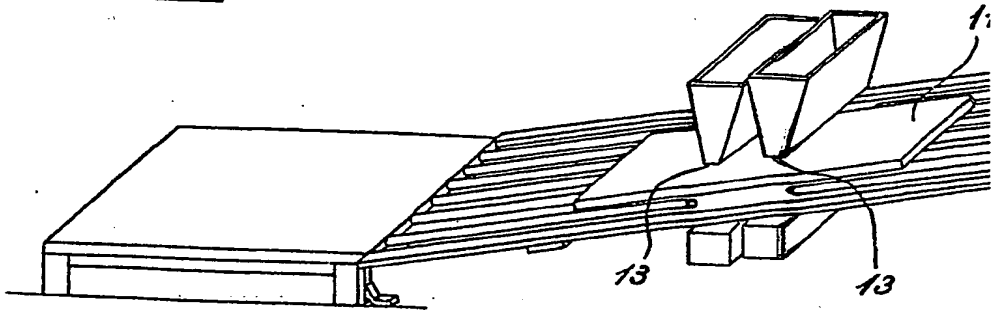


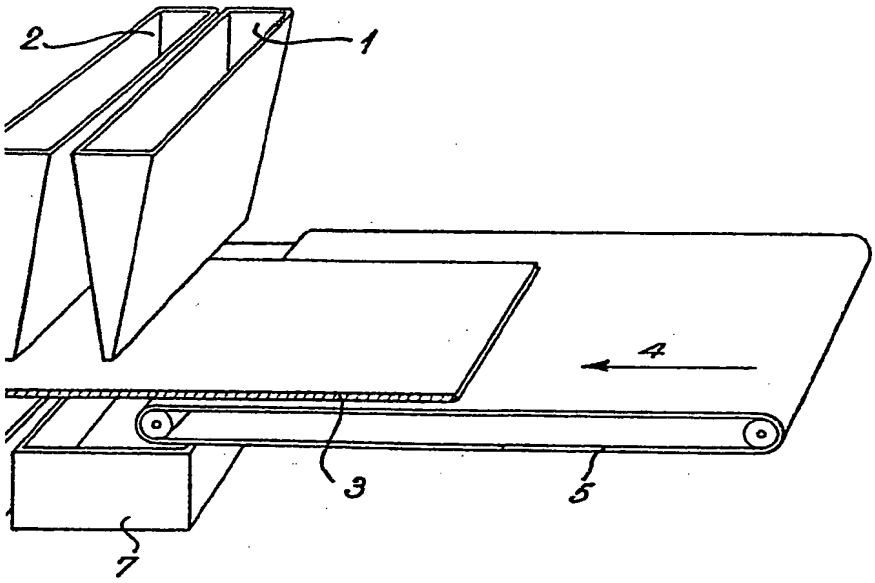
Fig: 2

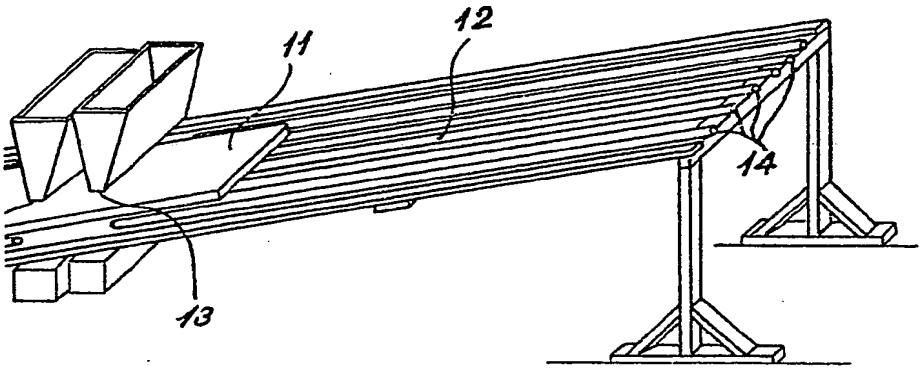


838,392 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.





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1 SHEET

Fig. 1

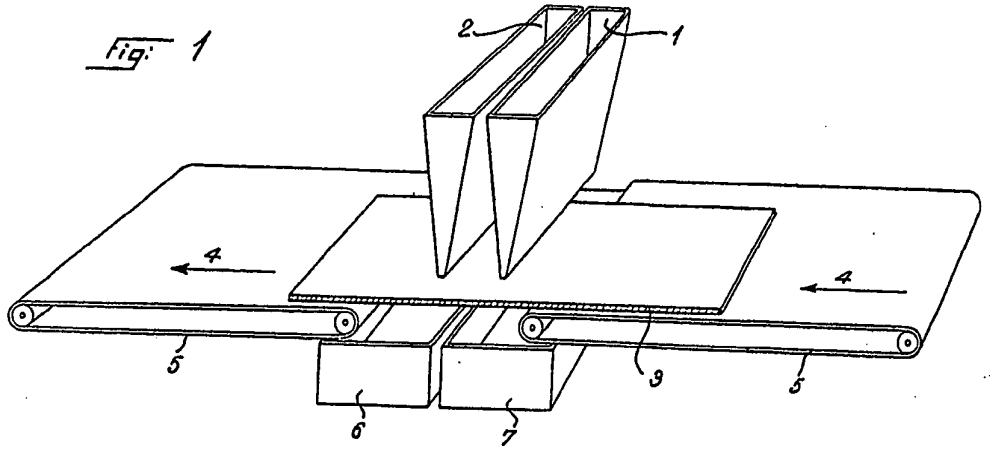

Fig. 2